

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

As rescanning documents *will not* correct images,  
please do not report the images to the  
**Image Problem Mailbox.**



(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 83110839.4

(51) Int. Cl.: B 61 L 27/00

(22) Date of filing: 28.10.83

(20) Priority: 02.11.82 JP 193231/82

(71) Applicant: Kawasaki Jukogyo Kabushiki Kaisha,  
1-1 Higashikawasaki-cho 3-chome, Chuo-ku Kobe-shi  
Hyogo-ken (JP)

(43) Date of publication of application: 16.05.84  
Bulletin 84/20

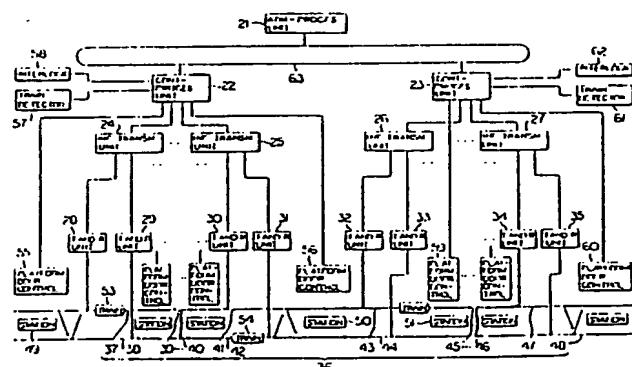
(72) Inventor: Miki, Hiromu, 4-8, Takaoka-1-chome,  
Ohkubocho, Akashi-shi (JP)  
Inventor: Tomizawa, Yukio, 425-22, Wada, Inamicho,  
Kako-gun, Hyogo-ken (JP)

(84) Designated Contracting States: DE FR GB

(74) Representative: Strehl, Peter, Dipl.-Ing. et al, Strehl,  
Schübel-Höpf, Schulz Patentanwälte  
Widenmayerstrasse 17 Postfach 22 03 45,  
D-8000 München 22 (DE)

(54) Method and apparatus for administration and control of train service.

(57) Transmitter and receiver units (28, ..., 31, 32 ..., 35) each connected to corresponding one of a plurality of sections (37, ..., 42; 43 ..., 48) of an information transmission line (36), information transmission units (24, 25; 26, 27), control-processing unit (22; 23) and a single administration-processing unit (21) are arranged to form a hierarchy structure. The administration-processing unit (21) monitors the operation of the whole system and supplies to the control-processing units (22; 23) information relating to a strain service schedule of a group of trains, a modified train service schedule to meet a change in demand, etc., and the control-processing units (22; 23) performs the traffic control of each train.





Europäisches Patentamt  
European Patent Office  
Office européen des brevets

(11) Publication number:

0 108 363

A2

- A61L 2%

(12)

## EUROPEAN PATENT APPLICATION

- B61L 2%

(21) Application number: 83110839.4

(51) Int. Cl.<sup>2</sup>: B 61 L 27/00

(22) Date of filing: 28.10.83

(30) Priority: 02.11.82 JP 193231/82

(71) Applicant: Kawasaki Jukogyo Kabushiki Kaisha  
1-1 Higashikawasaki-cho 3-chome  
Chuo-ku Kobe-shi Hyogo-ken(JP)

(43) Date of publication of application:  
16.05.84 Bulletin 84/20

(72) Inventor: Miki, Hiromu  
4-8, Takaoka-1-chome  
Ohkubocho, Akashi-shi(JP)

(84) Designated Contracting States:  
DE FR GB

(72) Inventor: Tomizawa, Yukio  
425-22, Wada, Inamicho  
Kako-gun, Hyogo-ken(JP)

(74) Representative: Strehl, Peter et al,  
Dipl.-Ing. P. Strehl Dr. U. Schübel-Hopf Dr. R. Schulz  
Patentanwälte Widenmayerstrasse 17 Postfach 22 03 45  
D-8000 München 22(DE)

DOC

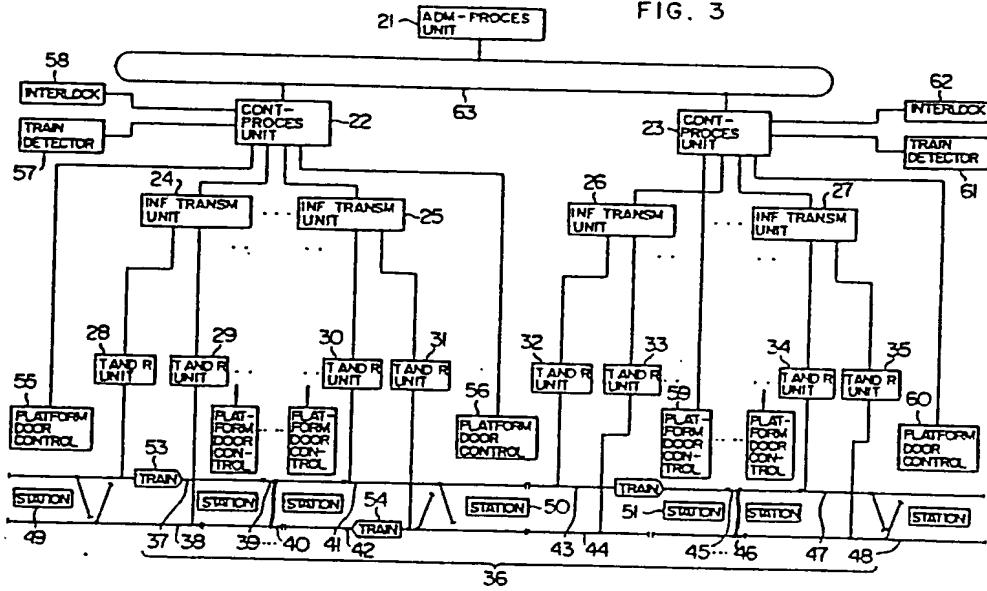
(54) Method and apparatus for administration and control of train service.

(57) Transmitter and receiver units (28, ..., 31, 32 ..., 35) each connected to corresponding one of a plurality of sections (37 ..., 42; 43 ..., 48) of an information transmission line (36), information transmission units (24, 25; 26, 27), control-processing unit (22; 23) and a single administration-processing unit (21) are arranged to form a hierarchy structure. The administration-processing unit (21) monitors the operation of the whole system and supplies to the control-processing units (22; 23) information relating to a train service schedule of a group of trains, a modified train service schedule to meet a change in demand, etc., and the control-processing units (22; 23) performs the traffic control of each train.

EP 0 108 363 A2

./...

FIG. 3



36

METHOD AND APPARATUS FOR  
ADMINISTRATION AND CONTROL OF TRAIN SERVICE

1        This invention relates to a method and apparatus for administration and control of train service.

Prior art train service administration and control systems which can attain unmanned train operation are broadly classified into a so-called centralized control type and a so-called decentralized control type. The prior art system of the centralized control type is shown in FIG. 1. Referring to FIG. 1, an information transmission line 6 extending along the entire length 10 of the track (not shown) laid for running of trains 7A to 7X (of which only two, 7A and 7X, are shown) is divided into a plurality of sections 6A, 6B, 6C, 6D, ..., 6K, 6L, 6M and 6N (some of which are not shown). Transmitter and receiver units 5A, 5B, ..., 5M and 5N are respectively connected to the individual sections 6A, 6B, ..., 6M and 6N of the information transmission line 6. (The transmitter and receiver units 5C to 5L corresponding to the sections 6C to 6L respectively are not shown to avoid confusion of illustration.) A single or a plurality 20 of information transmission units 4 are connected to all of the transmitter and receiver units 5A, 5B, ..., 5M and 5N to transmit and receive information required for the control of the operation of the trains 7A to 7X existing within the extent of the sections 6A to 6N of the information transmission line 6. (In FIG. 1,

1 a single information transmission unit 4 is shown.)  
Connected to the information transmission unit 4 is a  
train service administration and control unit 1 to  
exchanging information with the information trans-  
5 mission unit 4. Connected to the train service  
administration and control unit 1 are platform door  
control units 10A to 10Z controlling opening and closure  
of doors disposed at the platform of stations 8A to 8Z.  
Connected also to the train service administration  
10 and control unit 1 are a train detection unit 11 and an  
interlocking operation unit 12. Both of the train  
service administration and control unit 1 and the informa-  
tion transmission unit 4 are collectively installed  
in a central control center. The train service  
15 administration and control unit 1 functions to prepare  
the train service schedule, administrate the group of the  
trains and control the operation of the individual trains.

According to such a train service administration  
and control system of the centralized control type, the  
20 structure of its control system can be simplified, and  
all of necessary information can be collected in the  
train service administration and control unit 1. There-  
fore, this system has such an advantage that the operators  
can acquire all the information of the whole system and  
25 can readily intervene or interrupt in the control as  
required. This system has such another advantage that the  
installation of the important parts of the system in the  
central control center facilitates maintenance of those

1 parts. However, the prior art system of the centralized  
control type has such a disadvantage that, in the event  
of occurrence of an accident, the load attributable to  
the accident is added to the normal load of the train  
5 service administration and control unit 1, and the response  
speed for processing is inevitably reduced due to the  
concentration of the loads to be processed. Further, the  
prior art system of the centralized control type has  
such another disadvantage that the expansion of the system  
10 to deal with an extension of the train track is difficult  
since the load to be processed by the unit 1 is generally  
proportional to the length of the track or the frequency  
of train service.

The prior art train service administration and  
15 control system of the decentralized control type is shown  
in FIG. 2. In FIG. 2, the same reference numerals are  
used to designate the same or equivalent parts appearing  
in FIG. 1. In the system of the distributed control  
type, station control units 9A to 9Z are disposed for the  
20 individual stations 8A to 8Z respectively. All of these  
station control units 9A to 9Z are connected to the  
train service administration and control unit 1. Con-  
nected to the station control units 9A to 9Z are the plat-  
form door control units 10A to 10Z, interlocking operation  
25 units 12A to 12Z and station information transmission  
lines 13A to 13Z respectively. Information of a train or  
trains stopped at the station or stations and information  
of the individual stations are exchanged between the train

1 service administration and control unit 1 and the station  
control units 9A to 9Z. The train service administration  
and control 1 monitors generally the status of the indi-  
vidual trains 7A to 7X and applies to the station control  
5 units 9A to 9Z, the train control information for control-  
ling the trains according to a predetermined schedule of  
train service. The station control units 9A to 9Z control  
the operation of the trains 7A to 7X according to a  
predetermined sequence and timing. While the trains 7A  
10 to 7X are running, the train service administration and  
control unit 1 monitors the status of the trains on the  
basis of information applied through the information  
transmission unit 4 and transmits the control command  
through the information transmission unit 4.

15 The system of the decentralized control type has  
such an advantage that the load processed by the train  
service administration and control 1 can be distributed  
to improve the response speed for processing. However,  
due to the fact that the component units of the system  
20 are widely distributed, the maintenance of the distri-  
buted units is not easy, and the necessity for providing  
two systems of the train information transmission line 6  
and station information transmission lines 13, leads to  
an increase in the cost. Further, when any one of the  
25 station control units 9A to 9Z is disabled, the function  
of the disabled one of the station control units 9A to  
9Z cannot be substituted by the train service administra-  
tion and control unit 1 disposed in the central control

1 center and since the trouble cannot be dealt with by  
intervention from the central control center, an operator  
must be dispatched to the associated stations 8A to 8Z  
for which the station control units 9A to 9Z are provided  
5 respectively. The prior art system of the distributed  
control type is therefore defective in that the unmanning  
of the stations cannot be realized in such an event.

With a view to solve the technical problems en-  
countered by the prior art systems described above, it is  
10 a primary object of the present invention to provide a  
method and apparatus for administration and control of  
train service, which increases the response speed for  
processing, facilitates an expansion of the system to deal  
with an extension of the train track and yet permits easy  
15 maintenance of the system.

The present invention provides a method and  
apparatus for train service administration and control  
including means for exchanging information including  
status information indicative of the operating status of  
20 each of a plurality of trains running on the track and  
command information controlling the operation of the  
train, through an information transmission line divided  
into a plurality of sections of a predetermined length  
extending along the entire length of the track thereby  
25 controlling the train operation according to a train  
service schedule, the apparatus comprising a plurality  
of transmitter and receiver units connected individually  
to the sections of the information transmission line,

1 at least one information transmission unit installed in  
a central control center to be connected to at least one  
of the transmitter and receiver units, at least one control-  
processing unit installed in the central control center  
5 to be connected to the information transmission unit,  
and a single administration and control unit installed  
in the central control center to be connected to the  
control-processing unit, all of the units being disposed  
in a hierarchy in the above order, so that the distribu-  
10 tion of processing functions to the administration-  
processing unit and control-processing unit can improve  
the response speed of these processing units.

The present invention differs from the prior art  
system of the centralized control type in that the train  
15 service administration-processing unit is divided into a  
single administration-processing unit and a plurality of  
control-processing units constituting a hierarchy  
structure, and the tasks of the processing for administ-  
ration and the processing for control are respectively  
20 allocated to respective stages of the hierarchy thereby  
improving the response speed for processing. The present  
invention differs also from the prior art system of the  
distributed control type in that all of information are  
collected in a central control center for conveniences  
25 of the operators, and simplification of the structure of  
the system and improvement in the maintenance are  
further achieved.

Preferred embodiments of the present invention

1 will now be described in detail with reference to the drawings.

FIGS. 1 and 2 are block diagrams illustrating the prior art train service administration and control 5 systems.

FIG. 3 is a block diagram of a preferred embodiment of the present invention.

FIG. 4 is a block diagram showing the detailed structure of the control-processing unit 22 shown in 10 FIG. 3.

FIG. 5 is a block diagram of another preferred embodiment of the present invention.

Referring to FIG. 3 which is a block diagram of a preferred embodiment of the present invention, the 15 train service administration and control system according to the present invention comprises an administration-processing unit 21, a plurality of or, for example, two control-processing units 22 and 23, a plurality of information transmission units 24, ..., 25 and 26, ..., 27 20 (some of which are not shown), and a plurality of transmitter and receiver units 28, 29, ..., 30, 31, 32, 33, ..., 34 and 35 (some of which are not shown). The administration-processing unit 21 and the control-processing units 22, 23; the control-processing units 25 22, 23 and the information transmission units 24 to 27; and the information transmission units 24 to 27 and the transmitter and receiver units 28 to 35 are disposed in a hierarchy as shown.

1           An information transmission line 36 extends  
2         along the entire length of the track laid for running of  
3         trains (of which only two, 53 and 54, are shown). This  
4         information transmission line 36 is divided into a plu-  
5         rality of sections 37, 38, 39, ..., 40, 41, 42, 43, 44,  
6         45, ..., 46, 47 and 48 (some of which are not shown in  
7         FIG. 3). The sections 37 to 42 of the information  
8         transmission line 36 are those disposed along a section  
9         of track which was constructed in the first stage of the  
10       track construction work, while the sections 43 to 48 of  
11       the information transmission line 36 are those disposed  
12       along an extended track section which was constructed  
13       in the second stage of the track construction work carried  
14       out to extend the track. Stations 49, ..., 50 are those  
15       provided in the first stage of the track construction  
16       work, while stations 51, ..., 52 are those provided in  
17       the second stage of the track construction work. The  
18       transmitter and receiver units 28 to 35 are disposed in  
19       a relation individually corresponding to the sections 37  
20       to 48 respectively of the information transmission line  
21       36. (The transmitter and receiver units corresponding  
22       to the sections 39, ..., 40 and 45, ..., 46 of the  
23       information transmission line 36 are not shown.) These  
24       transmitter and receiver units 28 to 35 are installed in  
25       the individual stations nearest thereto or two or more  
       of them are collectively installed in each of the key  
       stations of a plurality of stations.

The transmitter and receiver units 28 to 35

1 are divided into a plurality of groups (some of which  
are not shown), and the information transmission units 24  
to 27 are disposed in a relation corresponding individually  
to the groups of the transmitter and receiver units 28  
5 to 35. In FIG. 3, the transmitter and receiver units  
28 and 29 are connected to the information transmission  
unit 24, and the transmitter and receiver units 30 and 31  
are connected to the information transmission unit 25.  
The transmitter and receiver units 32 and 33 are connected  
10 to the information transmission unit 26, and the transmitt-  
ter and receiver units 34 and 35 are connected to the  
information transmission unit 27.

The information transmission units 24 to 27 are  
divided into a plurality of groups, for example, two  
15 groups as shown, and the control-processing units 22 and  
23, which may be composed of computers, are disposed in  
a relation individually corresponding to the groups of the  
information transmission units 24 to 27. The information  
transmission units 24 to 25 are connected to the control-  
20 processing unit 22, and the information transmission  
units 26 to 27 are connected to the control-processing  
unit 23.

Connected also to the control-processing unit  
22 are platform door control units 55 to 56 controlling  
25 the opening and closure of doors disposed at the platform  
of the stations in relation to the opening and closure  
of the doors of the trains 53 to 54 running along the  
corresponding sections of the track, a train detection

1 unit 57 detecting the position of the trains 53 to 54,  
and an interlocking operation unit 58 controlling the  
route of advancing movement of the trains 53 to 54 and  
indicating the advancing route status. Connected also to  
5 the control-processing unit 23 are platform door control  
units 59 to 60 similar to the platform door control units  
55 to 56, a train detection unit 61 similar to the  
train detection unit 57, and an interlocking operation  
unit 62 similar to interlocking operation unit 58.

10 The control-processing units 22 and 23 are  
connected to each other and to an administration-processing  
unit 21, which may be also composed of a computer, through  
an exclusive circuit 63 which is in the form of , for  
example, an optical fiber cable or a coaxial cable.

15 The administration-processing unit 21, control-processing  
unit 22 and information transmission units 24 to 25  
are collectively installed in a central control center.  
The control-processing unit 23 and information transmission  
units 26 to 27 are collectively installed in a sub-  
20 control center. The central control center and sub-  
control center may be located in the same place or  
separate places.

The administration-processing unit 21, which  
is of the high echelon in the hierarchy arrangement,  
25 exchanges information with the control-processing units  
22 and 23 of the lower echelon through the exclusive  
circuit 63, to carry out processing for the purpose of  
administration. The administration-processing unit 21

1 supplied to the control-processing units 22 and 23 the  
information including the train service schedule prepared  
for the group of the trains 53 to 54, modified schedule  
required to deal with, for example, a change of the trans-  
5 portation demand and occurrence of an accident, and inter-  
vening or interrupt information for inhibiting departure of  
or emergency stopping of a train or trains. The admini-  
stration-processing unit 21 functions also to monitor the  
status of the train service administration and control  
10 system.

The control-processing unit 22 receives train  
status information from the sections 37 to 42 of the  
information transmission line 36 through the trans-  
mitter and receiver units 28 to 31 and information  
15 transmission units 24 to 25. The control-processing  
unit 22 receives also platform door status information  
from the platform door control units 55 to 56, trains  
position information from the train detection unit 57  
and train advancing route status information from the  
20 interlocking operation unit 58. In response to the  
train service schedule information and interrupt information  
supplied from the administration-processing unit 21, the  
control-processing unit 22 generates train control command  
information, platform door control command information and  
25 route setting command information with appropriate timing  
on the basis of the train status information, platform  
door status information, train position information and  
train advancing route status information applied thereto.

1 FIG. 4 is a block diagram showing the detailed  
structure of the control-processing unit 22 shown in  
FIG. 3. Referring to FIG. 4, the control-processing  
unit 22 includes a timer 70, a plurality of memory  
5 parts 71, 72, 73, 74, 75 and 76, a plurality of selector  
parts 77, 78 and 79, a plurality of output parts 80, 81  
and 82, and a plurality of checking parts 83, 84 and 85.

The timer 70 performs time keeping operation.  
The first memory part 71 stores the train operation schedule  
10 information supplied from the administration-processing  
unit 21. The second memory part 72 stores the interrupt  
information supplied from the administration-processing  
unit 21. The third memory part 73 stores the train  
position information supplied from the train detection  
15 unit 57. The fourth memory part 74 stores the train  
status information supplied from the information transmis-  
sion units 24 to 25. The fifth memory part 75 stores  
the platform door status information supplied from the  
platform door control units 55 to 56. The sixth memory  
20 part 76 stores the train advancing route status informa-  
tion supplied from the interlocking operation unit 58.

The selector 77, 78 and 79 are actuated in  
response to the application of the train position  
information together with the time information and select  
25 a train control command, a platform door control command  
and a route setting command respectively depending on the  
train service schedule. The first output part 80 supplies  
the selected train control command information to the

1 information transmission units 24 to 25. The second  
output part 81 supplies the selected platform door control  
command information to the platform door control units  
55 to 56. The third output part 82 supplies the selected  
5 route setting command information to the interlocking  
operation unit 58.

The first checking part 83 compares the train  
control command information supplied from the first output  
part 80 to the information transmission units 24 to 25,  
10 with the train status information supplied to the first  
memory part 74 from the information transmission units 24  
to 25, and if there is a non-coincidence therebetween,  
informs the administration-processing unit 21 of the  
presence of non-coincidence or trouble. The second  
15 checking part 84 compares the platform door control com-  
mand information supplied from the second output part 81  
to the platform door control units 55 to 56, with the  
platform door status information supplied to the fifth  
memory part 75 from the platform door control units 55  
20 to 56, and, if there is a non-coincidence therebetween,  
informs the administration-processing unit 21 of the  
presence of non-coincidence or trouble. The third check-  
ing part 85 compares the route setting command information  
supplied from the third output part 82 to the interlocking  
25 operation unit 58, with the train advancing route  
status information supplied to the sixth memory part 76  
from the interlocking operation unit 58, and, if there  
is a non-coincidence therebetween, informs the administra-  
tion-processing unit 21 of the presence of non-coincidence

1 or trouble.

When such a non-coincidence is found as a result of the check for comparison between the train status information and the train control command information, between 5 the platform door status information and the platform door control command information and/or between the train advancing route status information and the route setting command information, the control-processing unit 22 supplies a non-coincidence information output indicative of the presence of the non-coincidence or trouble to the administration-processing unit 21. Also the control-processing unit 10 22 supplies the train status information, platform door status information and train advancing route status information to the administration-processing unit 21.

15 The administration-processing unit 21 supplies the train service schedule information to the control-processing unit 22 and, when so required, supplies also manual interrupt information by the operator for train departure inhibition, emergency train stopping, door 20 opening-closure, etc. with appropriate timing. On the basis of the train service schedule information and interrupt information and in response to the train position information applied together with the time information as trigger the control-processing unit 22 selects and stores 25 the required train control command information, platform door control information and route setting command information in the respective selectors, and send these command information at appropriate timing. When a

1 predetermined period of time has elapsed or when any one  
of the statuses changes after sending of the command  
information from the control-processing unit 22, the  
specific status information and command information are  
5 checked to be compared with each other. When the result  
of the comparison check proves that there is a non-  
coincidence therebetween, the administration-processing  
unit 21 at the highest echelon is informed of the presence  
of non-coincidence or trouble.

10           The other control-processing unit 23 has a  
structure similar to that of the control-processing unit  
22 and executes functions similar to those of the control-  
processing unit 22. Further, the second stage of the  
track construction work can be started at any desired  
15 time after the first stage of the track construction  
work was completed, and it can be made while the trains  
are running on the first stage track, and the second con-  
trol-processing unit 23 can be very easily connected to  
the administration-processing unit 21 by connecting the  
20 exclusive circuit 63.

              The information transmission units 24 to 27  
transmit the command information to the trains 53 to 54  
through the transmitter and receiver units 28 to 35 and  
the sections 37 to 48 of the information transmission  
25 line 36 according to a predetermined information  
transmission sequence. Further, the information trans-  
mission units 24 to 27 scan the status information of  
each of the trains 53 to 54 at intervals of a

1 predetermined period of time for detecting any change in  
the status of each train. When the result of scanning  
proves that a change has occurred in the status of any  
one of the trains, the corresponding one of the infor-  
5 mation transmission units 24 to 27 transmits the  
status information of the specific train to the associated  
one of the control-processing units 22 and 23 at the higher  
echelon.

The administration-processing unit 21 monitors  
10 the status of the train service administration and  
control system on the basis of the train status informa-  
tion, platform door status information and trouble  
information supplied from the control-processing units  
22 and 23 and sends out interrupt information to the cont-  
15 rol-processing units 22 and 23. More precisely, the  
administration-processing unit 21 supplies to the  
control-processing units 22 and 23 the information  
including the train service schedule prepared for the  
train group, modified train service schedule required  
20 to deal with, for example, a change of the transporta-  
tion demand and occurrence of an accident, and interrupt  
information for inhibiting departure of or emergency  
stopping of the train or trains, open-close control of  
the platform door or doors, etc. The administra-  
25 processing unit 21 functions also to offer various  
information indicative of the status of the system to the  
operators in the central control center, so that the  
operators monitoring the status of the system on the

- 1 control panel can operate the control console as required to supply to the control-processing units 22 and 23 the interrupt information for inhibiting departure or emergency stopping of a train or trains, open-close
- 5 control of the platform door or doors, etc.

FIG. 5 is a block diagram of another preferred embodiment of the present invention. In FIG. 5, the scan reference numerals are used to designate the same or equivalent parts appearing in FIG. 3. It is to be noted that, in order to provide redundancy, the administration-processing unit 21, control-processing units 22 and 23, information transmission units 24 to 27, and transmitter and receiver units 28 to 35 shown in FIG. 3 are replaced by a dual or duplex configuration of administration-processing units 21a and 21b, control processing units 22a, 22b and 23a, 23b, information transmission units 24a, 24b, ..., 25a, 25b and 26a, 26b, ..., 27a, 27b, and transmitter and receiver units 28a, 28b, 29a, 29b, ..., 30a, 30b, 31a, 31b and 32a, 32b, 33a, 33b, ..., 34a, 34b, 35a, 35b. It will be seen that the administration-processing units 21a and 21b; control-processing units 22a, 22b and 23a, 23b; information transmission units 24a, 24b, ..., 25a, 25b and 26a, 26b, ..., 27a, 27b; and transmitter and receiver units 28a, 28b, 29a, 29b, ..., 30a, 30b, 31a, 31b and 32a, 32b, 33a, 33b, ..., 34a, 34b, 35a, 35b are provided in dual or duplex to operate as a dual system or duplex system. Therefore, the system constructed in this way can

1 operate with higher reliability. Although this redundant  
arrangement is applied to each of the administration-  
processing unit 21, control-processing units 22 and 23,  
information transmission units 24 to 27 and transmitter  
5 and receiver units 28 to 35 in FIG. 5, it may be applied  
to at least one of them.

It will be understood from the foregoing detailed  
description of the present invention that the distribution  
of processing functions to the processing units arranged  
10 in a hierarchy can increase the response speed for  
processing. Further, because of the arrangement in which  
the administration-processing unit, control-processing  
unit and information transmission units are collectively  
installed in the central control center to collect all  
15 of the information in the central control center, the  
operators in the central control center can readily  
intervene in the processing by the administration-  
processing unit or control-processing unit in the event  
of an emergency so that unmanning of the trains and  
20 stations can be achieved. Further, the system according  
to the present invention requires only a single informa-  
tion requires only a single information transmission  
line compared with the prior art system of the dis-  
tributed control type. Therefore, the number of  
25 required units can be decreased and the system construc-  
tion can be simplified, thereby to make easy the main-  
tenance. Furthermore, because of the fact that the  
processing functions are so distributed that the

- 1 administration-processing unit participates in the processing for preparation of the train service schedule and the control-processing unit participates in the processing for train service control, an expansion of the
- 5 system to deal with an extension of the track can be easily done compared with that in the prior art system of the centralized control type.

## CLAIMS

1. A train service administration and control system including means for exchanging information including status information indicative of the operating status of a plurality of trains (53, ..., 54) running on the track, and command information controlling the operation of the train through an information transmission line (36) divided into a plurality of sections (37, 38, ..., 41, 42) of a predetermined length extending along the entire length of the track thereby controlling the train operation according to a train service schedule, characterized in that

a plurality of transmitter and receiver units (28, 29, ..., 30, 31) connected individually to said sections of said information transmission line, at least one information transmission unit (24, ..., 25) to be connected to at least one of said transmitter and receiver units, at least one control-processing unit (22) to be connected to said information transmission unit, and a single administration-processing unit (21) to be connected to said at least one control-processing unit, are connected to form a hierarchy structure in this order with said administration-processing unit at the top echelon.

2. A train service administration and control system as claimed in claim 1, characterized in that said administration-processing unit (21) and said control-processing unit (22) are connected to each other by an exclusive circuit (63).

3. A train service administration and control

system as claimed in claim 1 or 2, characterized in that at least one of said administration-processing unit (21), said control-processing unit (22), said information transmission unit (24, ..., 25) and the group of said plural transmitter and receive units (28, 29, ..., 30, 31) is further redundantly added to provide a multiplex system.

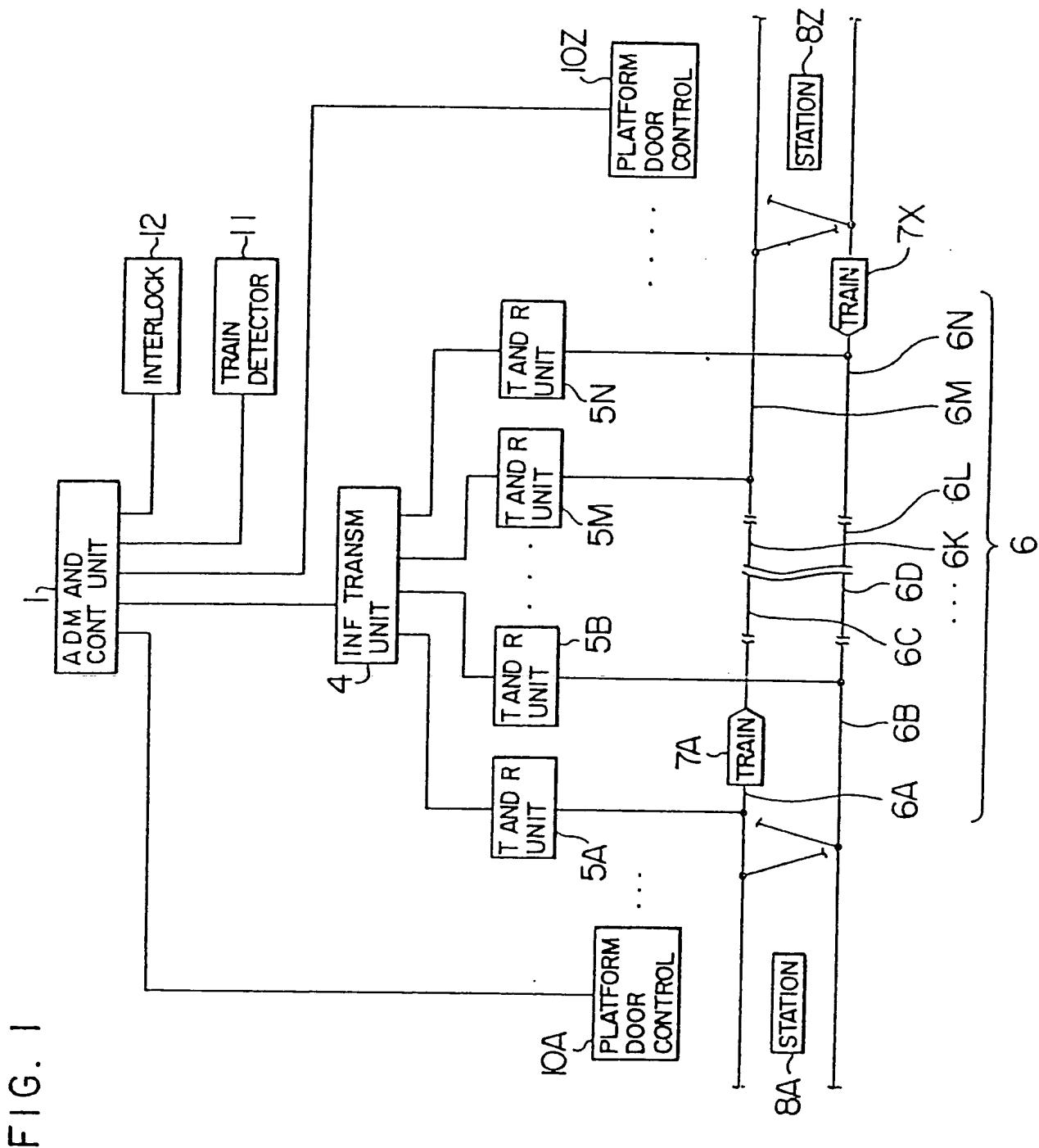
4. A train service administration and control system, as claimed in claim 1, 2 or 3, characterized in that,

there are further provided a plurality of information transmission line sections (43, 44, ..., 47, 48) of a predetermined length extending along an extension of said track, a plurality of transmitter and receiver units (32, 33, ..., 34, 35) connected individually to said information transmission line sections, at least one information transmission unit (26, ..., 27) to be connected to at least one of said transmitter and receiver units, and at least one control-processing unit (23) to said information transmission unit, all of said units being disposed in a hierarchy in the above order, with said control-processing unit (23) being connected to said administration-processing unit (21) of the highest order in the hierarchy arrangement.

5. A method for train service administration and control by a train service administration and control system as claimed in claim 1, 2, 3 or 4, characterized in that at least one control-processing unit (22) is connected to a single administration-processing unit

- 22 -

(21), train service schedule information from said administration-processing unit is supplied to said control-processing unit, and the service of trains (53, ..., 54) existing within the governing range of said control-processing unit is controlled by the function of said control-processing unit.



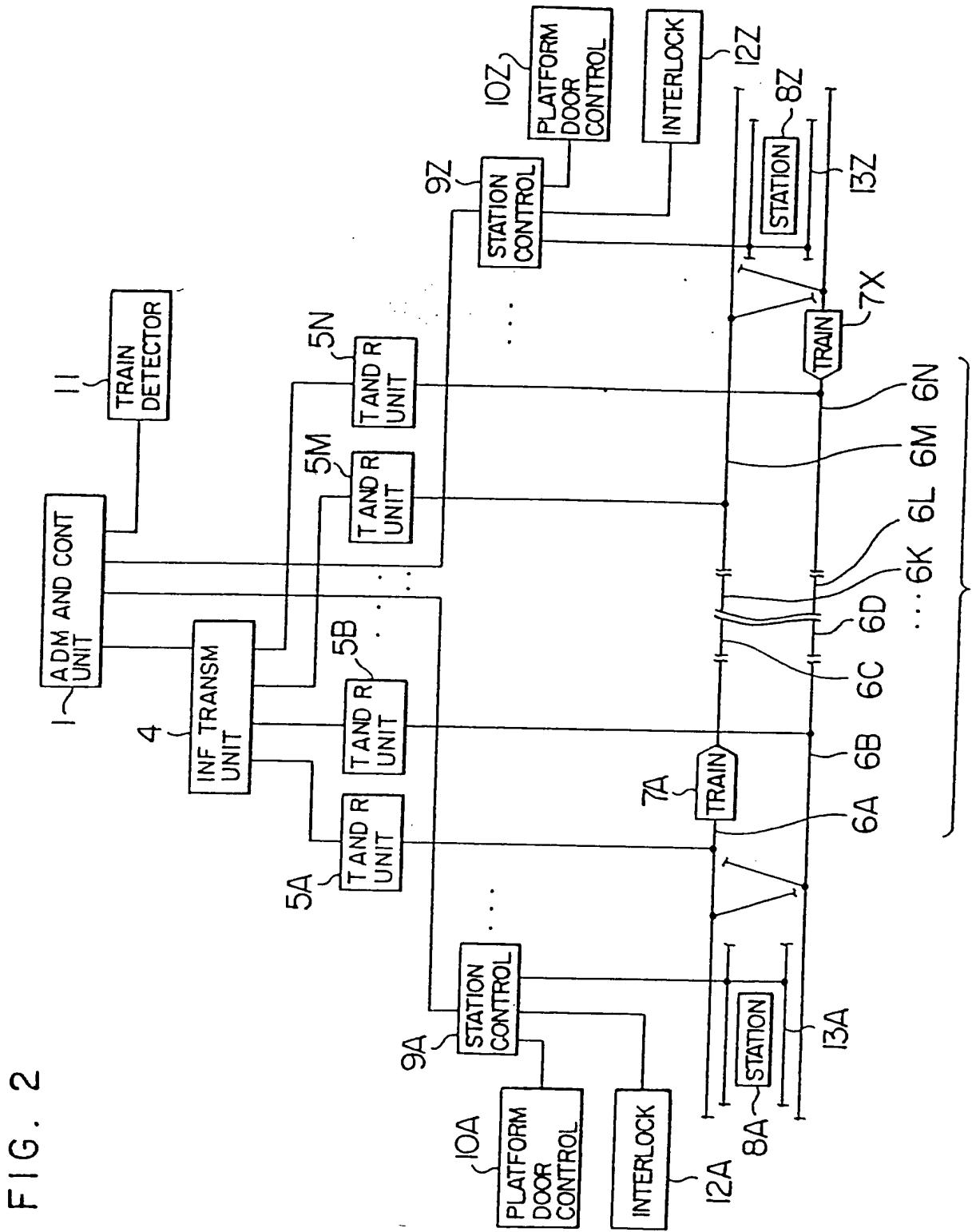


FIG. 3

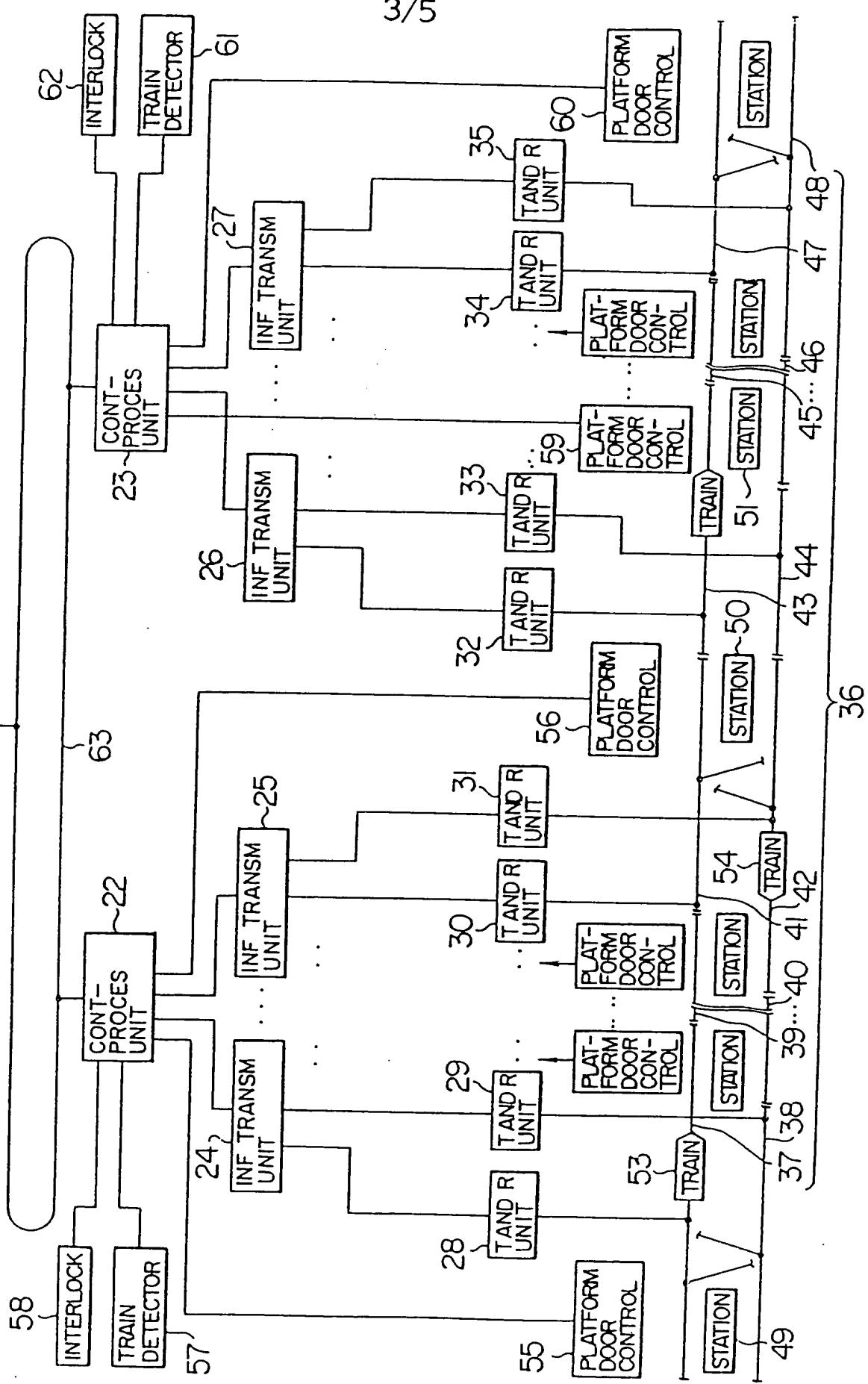
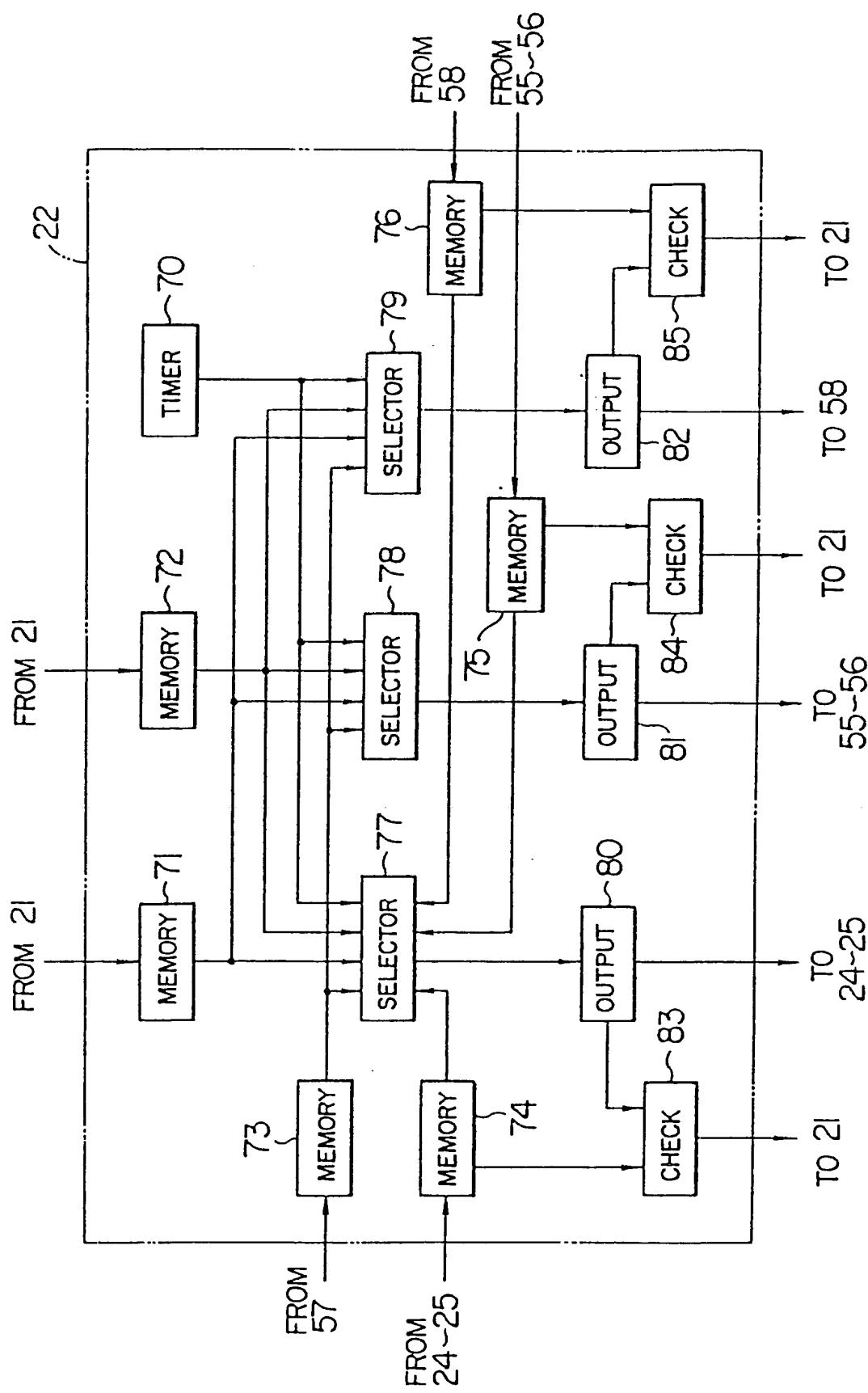


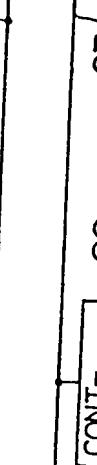
FIG. 4



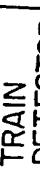
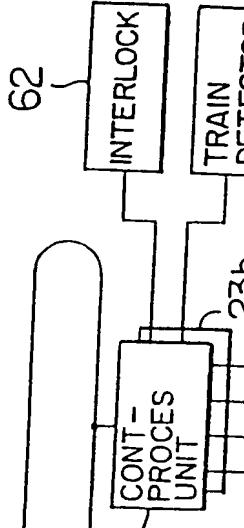
-1 G. 5



58



62



23b

23a

61



27a

27b



26a

26b



33a

33b



32a

32b



31a

31b



29a

29b



24b

24a



30a

30b



28a

28b



22a

22b



25a

25b



24a

24b



30a

30b



28a

28b



22a

22b



63

57



25a

25b



24a

24b



30a

30b



28a

28b



22a

22b



61

62



27a

27b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



35a

35b



34a

34b



European Patent  
Office

EUROPEAN SEARCH REPORT

0108363  
Application number

EP 83 11 0839

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.?)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	US-A-4 015 804 (DOBBLER et al.) * Claims *	1-5	B 61 L 27/00
A	---	1-5	
A	US-A-4 023 753 (DOBBLER) * Claims *	1-5	
A	---	1-5	
A	PATENTS ABSTRACTS OF JAPAN, vol. 1, no. 113, 29th September 1977, page 3427 M 77; & JP-A-52 49 511 (HITACHI SEISAKUSHO K.K.) 20-04-1977	1-5	
A	---	1-5	
A	PATENTS ABSTRACTS OF JAPAN, vol. 1, no. 54, 19th April 1978, page 581 M 78; & JP-A-53 13 705 (HITACHI SEISAKUSHO K.K.) 07-02-1978	1-5	
A	---	1-5	
A	PATENTS ABSTRACTS OF JAPAN, vol. 2, no. 137, 11th November 1977, page 4719 M 77; & JP-A-52 77 311 (HITACHI SEISAKUSHO K.K.) 29-06-1977	1-5	B 61 L
A	---	1-5	
A	PATENTS ABSTRACTS OF JAPAN, vol. 4, no. 103 (P-20) [585], 23rd July 1980; & JP-A-55 62 368 (HITACHI SEISAKUSHO K.K.) 10-05-1980	1-5	
	-----		
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	25-11-1986	REEKMANS M. V.	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone	T : theory or principle underlying the invention		
Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date		
A : technological background	D : document cited in the application		
O : non-written disclosure	L : document cited for other reasons		
P : intermediate document	& : member of the same patent family, corresponding document		